Astronomy, Physics and Space Technology Directorate

FarIR Surveyor
JPL Expertise and Interests

5/12/16

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JPL Experience and Interests for the Far IR Surveyor

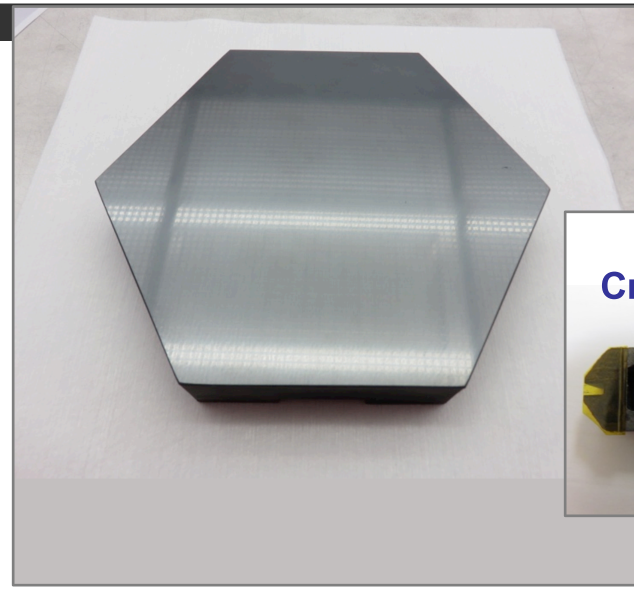
- Science participation (STDT, advisory council)
  - Experience with ground-based, suborbital, and space-based far-IR through milimeter-wave astrophysics and instrumentation.
  - Multiple flight missions and mission system studies.
  - Developing intensity mapping science experiments.
- Telescope
  - Including active mirrors, cryogenic design, system design
- Instrumentation
- High performance detectors

Far IR Active Mirror Technology

- Potential architectures for Far IR Surveyor will likely place challenging requirements on the telescope
- Actively controlled mirrors that operate at cryogenic temperatures may significantly reduce design and testing requirements and costs
- Draft objectives for mirrors:
  - (1) meet spec for 10 um diffraction limit
  - (2) can be tested to spec while warm, in 1 g
  - (3) will be operated at spec at 4K in 0 g
  - (4) minimize cost
  - (5) are scalable from 1 m to larger monoliths and segmented systems

JPL "Cryo Active Mirror" (CAM) study

- Build and test a 15 cm CAM demonstrator mirror, with:
  - SiC ribbed substrate, with surface-parallel actuators
  - PZT actuators with strain at ambient, and at cryo: 290 K to below 20 K
  - Athermalizing tabs for strain-free attachment of the actuators to the SiC substrate



- Characterize PZT actuator strain vs. applied field and temperature, to find best actuation method
  - Exploring linear and nonlinear methods, potentially leading to "zero-volt" set and hold actuation modes
  - Exploring best trajectory through V-T space to achieve desired displacement

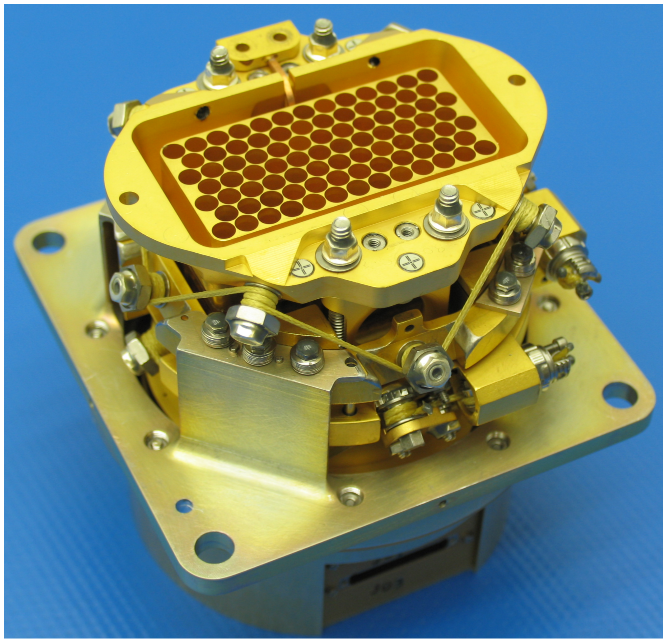
Future telescope+ studies

- Interested and experienced with system studies
  - Aperture vs. shroud volume and mass constraints
  - Monolith vs. segments
  - Wavefront control

- Overall thermal system design experience (Spitzer,Planck) and impacts on telescope and instrumentation

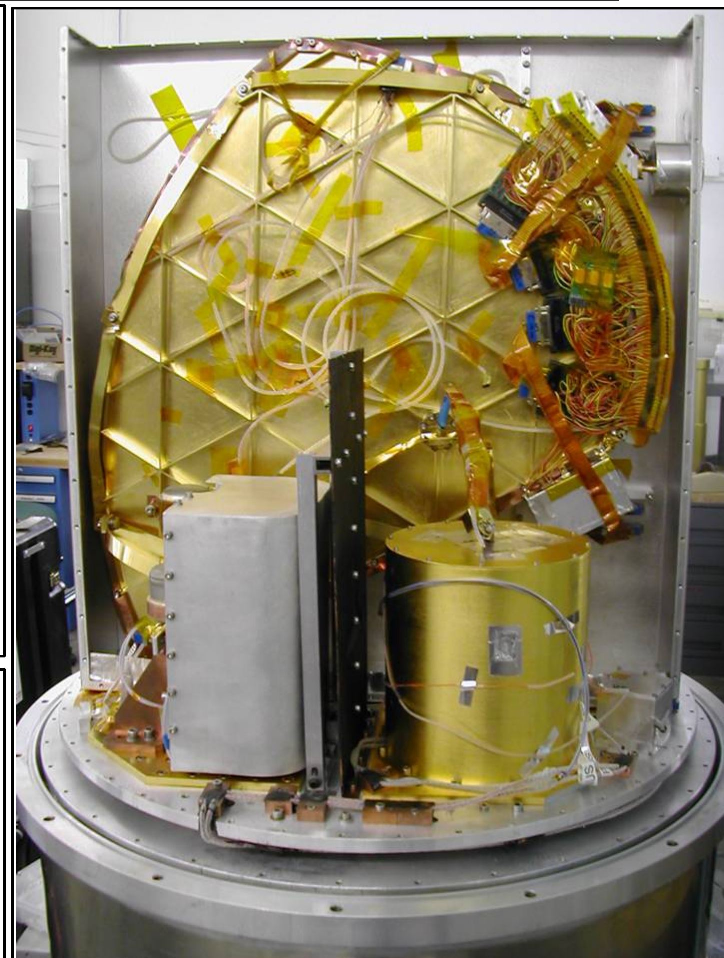
- Alternate mirror substrates
  - In conjunction with MSFC
  - Compare multiple mirror materials: Al, CFRP (Carbon Fiber), SiC and properties for cryogenic actuation

Instrumentation



Herschel SPIRE flight array package (1 of 5) Showing electroformed feedhorns + kevlar 0.3 K suspension supporting launch loads.

Herschel HIFI Band 5 mixer block. 1120-1250 GHz SIS mixer with T_{sys} ~ 1000 K



Z-Spec wideband mm-wave grating spectrometer used at CSO, APEX for CO redshifts & line surveys

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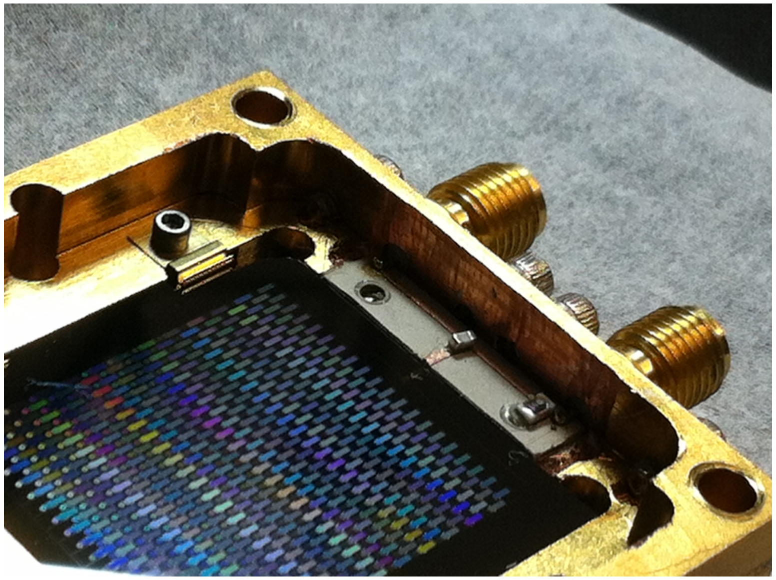
Large-Format Far-IR Detectors



MAKO kinetic-inductance detector (KID) camera.
350, 850 µm, ~400 detectors on a single readout line.

System can scale to 500 kpix for Surveyor.